THz sensing in front of Vehicle (Ground Profiling)

**Motivation**

**Aim**: To provide real time identification of roads’ image in complex environments (off-road, humps, kerbs) in severe weather conditions (rain, snow, spray).

**Existing Sensor technologies include**:
- Optical sensors
- Lidar (Lasers)
-Thermo-graphic cameras (for night vision)
-Radars at 24 GHz and 77 GHz

A fusion of technologies are usually used.

**Optical sensors** are most used for driver assistance/path detection. However they fail in:
- Spray/fog/smoke
- Sand/dust storm
- Snow/rain

**THz sensing**

- a) and c) Optical images in clear and foggy weather
- b) and d) Corresponding passive millimetre wave images

**Microwave sensing in THz band provides**
- High resolution
- Compact sensors/antennas

**THz sensing** enables optimisation of control systems including transmission, suspension, throttle mapping and torque to control vehicle progress on any terrain.

**Challenges**

- Atmospheric gases attenuation
- Water vapour absorption
- Oxygen absorption
- Precipitation Attenuation
- Rain
- Snow
- Foliage Blockage
- Scattering effects
- Diffused and specular reflections
- Diffraction

**Obstacle detection and avoidance in Robotics**

**Future applications**

- Autonomous vehicles
- Earth remote sensing
- Non-destructive testing of structural integrity
- Moisture content determination
- Coating thickness control
- Structural integrity
- Medical applications
- Concealed weapons detection

**Average atmospheric absorption of millimetre waves**

**Specific attenuation due to atmospheric gases (Oxygen and water vapour)**

**Specific attenuation (dB/km)**

**Frequency (GHz)**

**Frequency (GHz)**

**Wavelength (mm)**

**Attenuation of moist air for frequencies below 1000 GHz at sea-level and temperatures ± 40° C**

**Range**

**Average resolution**

**Average attenuation**

**Imaging of the road ahead**

Dr Marina Gashinova, gashinms@bham.ac.uk, +44(0) 121 414 7599


For more enquiries, please contact:
Dr Marina Gashinova, gashinms@bham.ac.uk, +44(0) 121 414 7599

www.eee.bham.ac.uk/misl